

04 -08- 1998

The Swedish Patent Office
PCT International Application

CLAIMS

(Amended on August 4, 1998)

5 *Cont. Sub #17*
1. A method for determining the position of a mobile station located in the coverage area of a base station in a radio system and for using said information, in which method the base station comprises equipment for receiving signals from the same mobile station simultaneously by at least two antenna beams (A) directed in different directions, and in which method:

10 the signal levels (B) of the signals received by the different antenna beams are measured,

the signal levels of the signals received from the same mobile station by the different antenna beams are compared (C, D, E),

15 the direction to the mobile station in relation to the base station is determined on the basis of the relations between the signal levels (F, G, H, I, J) measured for the different antenna beams, and

the distance from the mobile station to the base station is calculated on the basis of a timing advance (TA), given to the mobile station by the base station and the propagation speed of the radio signals, **characterized**
20 in that

said distance and said direction is used for making a handover decision on the basis of the location of the mobile station.

2. A method according to claim 1, **characterized** in calculating a mean value for the measuring results during a determined time period
25 (C) and determining the direction to the mobile station on the basis of the relations between the calculated mean values.

3. A method according to claim 1, **characterized** in choosing a beam by which signals with the strongest signal level have been received and at least one of the adjacent beams (D), comparing the measured
30 signal levels for the antenna beams in question (E), and determining the direction to the mobile station on the basis of the relation between the signal levels for the chosen antenna beams.

4. A method according to claim 1, **characterized** in determining that the mobile station is located
35 - in the centre (A1) of the first chosen beam, if the signal level (RSSI1) of the signals received by the beam in question (1) is essentially

higher than the signal level (RSSI2) of the signals received by the other chosen antenna beam (2),

- in the border area (A2) between the antenna beams, if the signal level (RSSI1, RSSI2) of the signals received by the chosen antenna beams (1, 2) is substantially the same, and

- between (A3) the centre (A1) of the first chosen antenna beam (1) and the border zone (A2) of the beams (1, 2), if the signal level (RSSI1) of the signals received by the first antenna beam (1) is somewhat higher than the signal level (RSSI2) of the signals received by the other antenna beam.

5. Base station (BTS1) of a radio system, which base station comprises

antenna equipment (1 - 4, 6, 7) for receiving signals from a certain mobile station simultaneously by at least two antenna beams (1 - 4) directed in different directions,

measuring equipment (8) for measuring the signal levels of the signals received by the different antenna beams,

equipment for defining a timing advance (TA) for the mobile station (MS) which is in radio connection with the base station to compensate for a time lag caused by the distance between the mobile station and the base station, and

calculation means (9) which are responsive to the measuring equipment (8) for determining the direction from the base station (BTS1) to the mobile station (MS) on the basis of the relations of the signal levels measured for the different antenna beams (1 - 4) and which calculation means (9) comprise equipment for calculating the distance between the base station (BTS1) and the mobile station (MS) on the basis of the timing advance (TA) defined for the mobile station and the propagation speed of the radio signals, **characterized** in that

said calculation means are adapted to transmit said direction and said distance further in the system in order to be used for making handover decisions.

6. Base station according to claim 5, **characterized** in that the calculation means (9) are arranged for calculating for each beam (1 - 4) the mean value of the signal levels of the signals received from the mobile station (MS) by the respective antenna beams, whereby the calculation means (9) are arranged to determine the direction from the base station (BTS1) to the

mobile station (MS) on the basis of relations between the calculated mean values.

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5 7. Base station according to claim 5, **characterized** in that the calculation means (9) include means for choosing the antenna beam (1) with the strongest signal level and at least one adjacent beam (2), whereby the calculating means (9) are arranged for determining the direction from the base station (BTS1) to the mobile station (MS) on the basis of the relations of the signal levels (RSSI1, RSSI2) of the signals received via the chosen antenna beams (1, 2).

10 8. Base station according to claim 5, **characterized** in that said base station is a base station (BTS1) of a cellular radio system divided into logical traffic channels in accordance with a TDMA principle.

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